Virtualized DNS, DHCP, and IPAM Services

White Paper by FusionLayer, Inc.

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Virtualized DNS, DHCP, and IPAM Services for the Edge

Edge cloud is playing an increasingly important role in digital transformation. At the same time, most enterprises continue to run Microsoft Active Directory on-premise to provide DNS and DHCP services as part of their campus, data center, and branch network operations. Emerging technologies such as private 5G networks, Artificial Intelligence (AI), and the Internet of Things (IoT) are driving computing from on-premise data centers to the network edges. This transition requires that core network services such as DHCP and DNS are extended to the network edges to manage the entire enterprise network reliably.

Businesses and individuals are deploying an ever-increasing number of Internet of Things (IoT) devices. Many of these next-generation devices are consuming considerable amounts of data processed in the cloud. The technology industry has responded to these developments by introducing new concepts such as private 5G networks and edge cloud that facilitate data processing closer to the end-users.

As the focus of edge clouds has primarily been on the application stacks used to deploy workloads and containers automatically, the fact that private edge cloud setups will become part of the enterprise networks has had less attention. However, managing seamless connectivity between the enterprise data centers and the edge cloud stacks is also crucial because lacking this ability can quickly lead to network downtime and security issues.

FusionLayer addresses these business risks with a patented network source of truth solution that allows organizations to manage their network, virtual LAN (VLAN), and IP address assignments seamlessly wherever they take place. With a modern Software-Defined IPAM (SD-IPAM) solution in place, organizations can introduce a single pane of glass to manage all segments of their enterprise networks across traditional on-premise, public clouds, and at the cloud edge.

It provides native support for traditional on-premise enterprise technologies such as Microsoft DNS and DHCP, F5 BIG-IP DNS; cloud providers such as Amazon Web Services (AWS) and Microsoft Azure; and popular edge cloud technologies such as VMware Edge and OpenStack. Making FusionLayer the ideal network source of truth for the modern enterprise.

This White Paper suggests a route for virtualizing DNS and DHCP services in an enterprise network incorporating edge cloud deployments.

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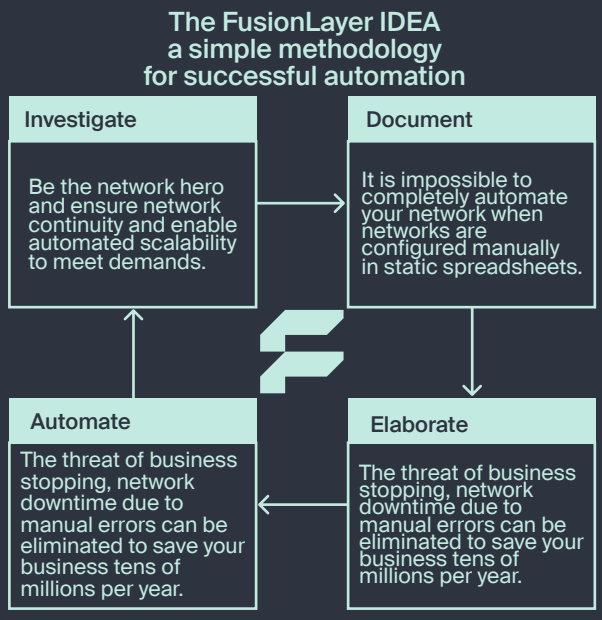
The Network Source of Truth Benefits for Modern Enterprise Network Infrastructure:

1. Elimination of enterprise network downtime. Which based on Gartner estimates costs USD 5,600 per minute for the average enterprise.
2. Visibility across all segments of enterprise networks on-premise, public clouds, and edge cloud stacks.
3. It Enforces secure network management processes for VLAN, subnet, IP address, and policy assignments. With Role-Based Access Control (RBAC), centralized authentication, and audit trails for API and GUI users.
4. Enables network and application deployment automation at the edge, thereby minimizing Operating Expenses and boosting service agility.
5. A single REST API into the network source of truth automates networking and the release parameter provisioning process for virtual workloads and containers.
6. It delivers highly-available and scalable virtualized DHCP and DNS services for the network edges and the edge cloud.



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Visibility and Network Agility for the Edge Cloud

Traditional enterprise networks typically leverage Microsoft DNS and DHCP services. However, they still use spreadsheets to manage VLAN spaces used in various on-premise data centers. As digital transformation introduces new application deployment models that involve data processing outside the on-premise data centers, the traditional network management processes carried out manually neither scale nor provide the level of security required today.

The disadvantages of traditional network management processes are as follows:

1. **Manual Management Processes**: L2 and L3 managed with several different tools and spreadsheets in enterprise networks lead to a lack of visibility. Enterprises do not have a single pane of glass to the networks where their operations are running.

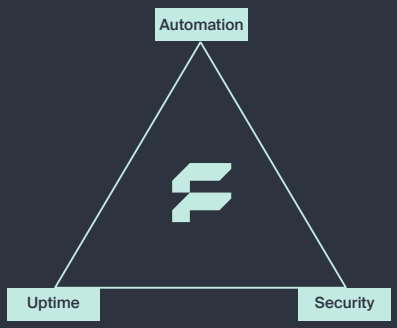
2. **Low-security Standards:** As enterprise networks span outside the private data centers, headquarters, and branch offices; their complexity rises. This complexity calls for standardized security processes, global visibility across different network environments, and audit trails on the subnet, VLAN, and IP address assignments across the organization.

3. **Network Downtime:** Due to increased network complexity and manual network management processes, the risk of assigning overlapping subnets, VLANs, and IP addresses increases dramatically. In turn, this can lead to network downtime and cause severe operational issues.

According to research, 49% of network downtime has traditionally occurred by manual mistakes that compromise its operational integrity. As the enterprise networks' complexity increases rapidly, the amount of network downtime caused by manual errors will grow exponentially. At the cost of USD 5,600 per minute, this is something that no organization can afford.

The easiest and the most cost-efficient way to eliminate these risks is to implement a modern network source of truth within the enterprise network. By enforcing universal security standards and management processes, an advanced network source of truth solution provides the foundation for reliable enterprise networking by providing a single pane of glass into the network assets and a single integration point for various automation initiatives.

Network Bliss Triangle



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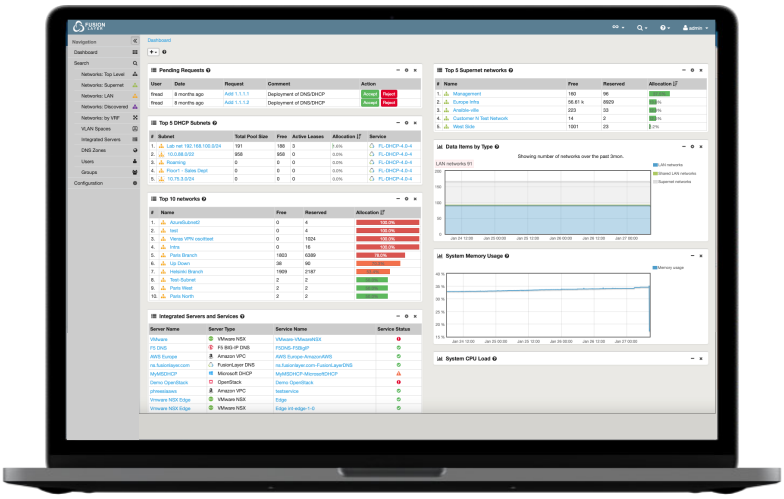
DNS, DHCP, and IP Addressing (DDI) Goes Virtual



FusionLayer Infinity is the world's first Software-Defined IP Address Management (SD-IPAM) solution designed for next-generation business infrastructures. By providing a single source of truth for all network information, including logical networks, VLANs, VRFs, NATs, and more, it enforces secure management processes while providing a single integration point for different orchestrators requiring network information for end-to-end automation.

FusionLayer DNS is a virtualized DNS server that implements a patented security methodology for protecting the operations. Typically deployed at the edge as a virtual machine on KVM or VMware, it allows enterprises to provide a highly-scalable, secure DNS service to the end-users connected to the cloud edge.

FusionLayer DHCP is a virtualized DHCP server that implements a built-in security methodology for secure and scalable IP addressing. Typically deployed at the edge as a virtual machine on KVM or VMware, it allows enterprises to provide a highly-scalable, hardened DHCP service to the end-users connected to the cloud edge.

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Solution Architecture and Related Considerations

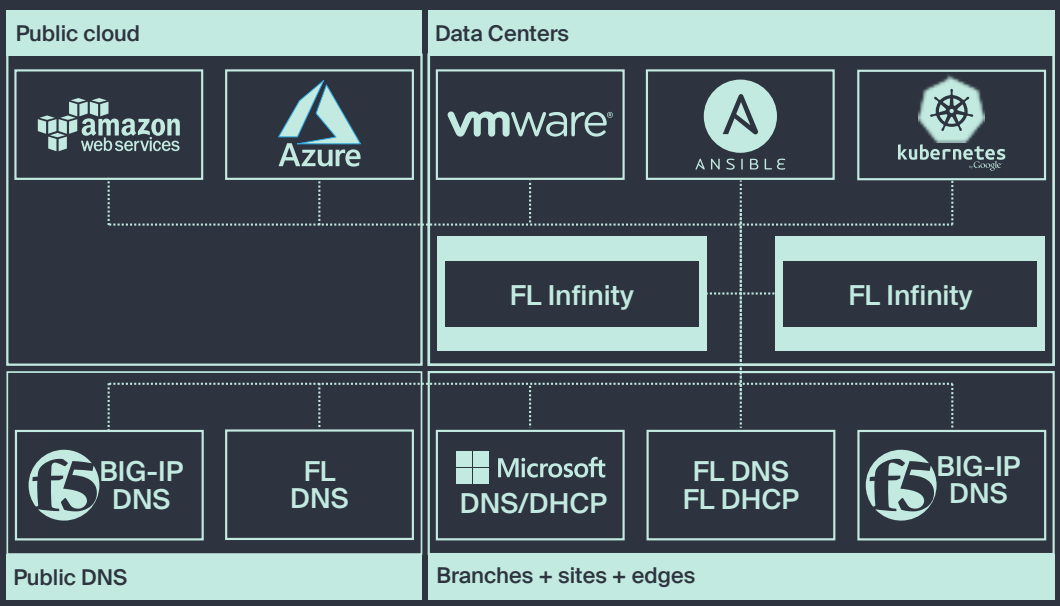

Figure 1: FusionLayer positioning in an advanced enterprise environment

The above diagram provides a simplified illustration of FusionLayer SD-IPAM, vDNS, and vDHCP services in an enterprise network environment and popular, commonly integrated, 3rd party technologies. The FusionLayer use-cases for each part of the network described below:

Data Centers:

1. Virtualized FusionLayer Infinity HA cluster functioning as the network source of truth. Aware of network and IP address assignments; VLAN spaces and VLAN assignments; and associated network data across the enterprise business infrastructure. With support for KVM and VMware.

2. The FusionLayer network source of truth integrates with VMware, Ansible, and Kubernetes orchestrators via Northbound REST API for application deployment and network automation. It facilitates zero-touch provisioning of new subnets, IP addresses, VLANs, and other network information.

3. The FusionLayer network source of truth integrates with existing Microsoft DHCP and possible FusionLayer vDHCP instances to enforce visibility and security for traditional on-premise DHCP services. KVM, VMware, and physical x86-based industry-standard servers are supported.

4. The FusionLayer Network source of truth integrates with existing Microsoft DNS, F5 BIG-IP DNS, and possible FusionLayer vDNS instances, enabling zero-touch DNS provisioning and simplified zone data management.

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DMZ – Public DNS:

1. The global FusionLayer Infinity network source of truth in the data center manages the DNS servers responsible for the public DNS service. The single source of truth is aware and can be used to manage all the public zone data and centrally monitor and manage the DNS server instances running on the public Internet.

2. Existing F5 BIG-IP DNS instances running in the DMZ. Due to built-in integration in FusionLayer management overlay running in data centers, the existing public DNS architecture requires no changes.

3. Existing FusionLayer DNS instances running in the DMZ as vDNS instances. Due to built-in integration in FusionLayer management overlay in the data center, the existing public DNS architecture requires no changes. KVM, VMware, and any x86-based physical industry-standard servers are supported.

Cloud Edges and Branches:

1. The global FusionLayer Infinity network source of truth in the data center manages the DNS servers responsible for the DNS services at the cloud edges and branch offices. The single source of truth is aware and can be used to manage all the private-zone data and centrally monitor and manage the DNS server used for internal DNS.

2. The global FusionLayer Infinity network source of truth in the data center manages the DHCP servers responsible for the DNS services at the cloud edges and branch offices. The single source of truth is aware and can administer all the private DHCP services – both at the cloud edges and in the branch offices.

3. Existing Microsoft DHCP instances running in the enterprise data centers and the branch offices. Due to built-in integration in FusionLayer management overlay in the data center, with no changes needed to the existing DHCP architecture.

4. Existing VMware Cloud Edge DHCP services running at the cloud edge. Due to the built-in integration in the FusionLayer management overlay in the data center, it is possible to manage both the traditional Microsoft DHCP services and the new VMware DHCP services in the edge cloud.

5. FusionLayer vDHCP server instances deployed at the edge enables centrally managed local DHCP services. KVM, VMware, and any x86-based physical industry-standard service are supported. The management overlay allows a mixture of Microsoft DHCP, VMware DHCP, and FusionLayer DHCP instances.

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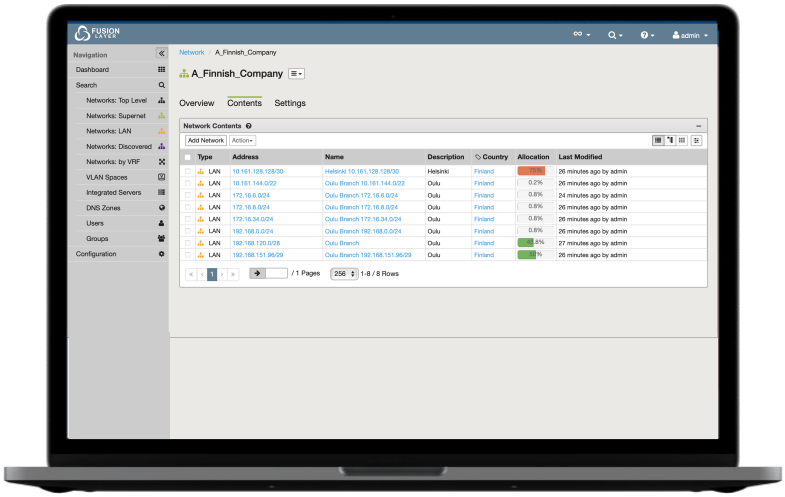
Public Clouds:

1. The global FusionLayer Infinity network source of truth in the data center manages the subnet assignments in public cloud services such as Amazon Web Services (AWS) and Microsoft Azure. The interaction with the public cloud services is carried out through the APIs that they provide, leveraging built-in hybrid models such as Virtual Private Cloud (VPC) and Virtual Networking (VNET).



2. The global FusionLayer Infinity network source of truth in the data center reads the subnet and IP address information from the public clouds. The retrieved data is globally visible in the network source of truth for human users via secure Graphical User-Interface and the orchestrators via REST API. The access for both humans and API clients is secured using HTTPS, centralized authentication and authorization, and extensive audit trails for all changes.

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About FusionLayer

Managing complex corporate and telecom networks is a challenge where the cost of failure is enormous. FusionLayer collates all network information into a single Network Source of Truth, accessed securely by both engineers and automation to eliminate the chance of network downtime – on-premise, at the edge, and in the public cloud. This collation provides our customers with reassuring real-time information, so their digitalized operations can connect 24x7x365.

For more information, please visit www.fusionlayer.com.

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